DECLARATION

I, Tatsuya Ina, a Patent Attorney, of Ogikubo TM Bldg. 2F, 5-26-13, Ogikubo, Suginami-ku, Tokyo 167-0051, Japan, solemnly and sincerely declare:

That I have a thorough knowledge of Japanese and English languages; and

That the attached pages contain a correct translation into English of the specification of the following Japanese Patent Application:

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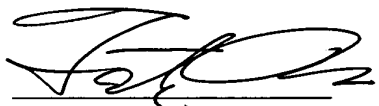

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[List of the Documents Attached]

[Document] Specification	1 copy
[Document] Drawings	1 copy
[Document] Abstract	1 copy
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[Designation of Document] SPECIFICATION

[Title of the Invention] SOLDERING METHOD, SOLDERING APPARATUS, AND METHOD OF AND APPARATUS FOR MANUFACTURING ELECTRONIC CIRCUIT MODULE

[Claims]

[Claim 1] A soldering method including bonding a first electronic component which has electrodes plated with a material containing lead, to one surface of an interconnect substrate through a solder containing no lead, and bonding a second electronic component to the interconnect substrate by performing flow soldering onto the other surface;

bonding parts between the first electronic component and said interconnect substrate being heated at or after the step of performing the flow soldering, thereby to melt the bonding parts.

[Claim 2] In the soldering method as defined in claim 1,

a soldering method wherein the step of heating said bonding parts is performed simultaneously with said step of performing said flow soldering.

[Claim 3] In the soldering method as defined in claim 1,

a soldering method wherein the step of heating said bonding parts is performed after said step of performing said flow soldering.

[Claim 4] In the soldering method as defined in claim 1,

a soldering method wherein the step of heating said bonding parts is performed simultaneously with and after said step of performing said flow soldering.

[Claim 5] In the soldering method as defined in any of claims 1 through 4,

a soldering method wherein, at the step of heating said bonding parts, the heating is performed by at least one of radiant heat and a hot blast.

[Claim 6] In the soldering method as defined in any of claims 1 through 5,

a soldering method wherein said first electronic component is bonded to said one surface of said interconnect substrate by performing reflow soldering.

[Claim 7] In the soldering method as defined in any of claims 1 through 5,

a soldering method wherein said first electronic component is bonded to said one surface of said interconnect substrate by performing soldering by handwork.

[Claim 8] In the soldering method as defined in any of claims 1 through 7,

a soldering method further including preheating said bonding parts before said step of performing the flow soldering.

[Claim 9] In the soldering method as defined in any of claims 1 through 8,

a soldering method wherein the solder containing no lead is formed of at least one material selected from the group consisting of tin, silver, copper, zinc and bismuth.

[Claim 10] In the soldering method as defined in any of claims 1 through 9,

a soldering method wherein at least the step of heating said bonding parts is performed in a chamber.

[Claim 11] A method of manufacturing an electronic circuit module wherein the first and second electronic components are mounted on said interconnect substrate by the soldering method as defined in any of claims 1 through 10.

[Claim 12] A soldering apparatus including a flow soldering device which, when a first electronic component having electrodes plated with a material containing lead is bonded to one surface of an interconnect substrate through a solder containing no lead, bonds a second electronic component to the other surface of the interconnect substrate;

said flow soldering device being provided with a heater which is arranged on a side of said one surface of said interconnect substrate, and which melts bonding parts between the first electronic component and said interconnect substrate.

[Claim 13] In the soldering apparatus as defined in claim 12,

a soldering apparatus wherein said flow soldering device has a solder

supplying portion which is arranged on a side of said other surface of said interconnect substrate; and

said heater is arranged over said solder supplying portion.

[Claim 14] In the soldering apparatus as defined in claim 12,

a soldering apparatus wherein said flow soldering device has a solder supplying portion which is arranged on a side of said other surface of said interconnect substrate; and

said heater is arranged on a lower stream side of said solder supplying portion in a transfer direction of said interconnect substrate.

[Claim 15] In the soldering apparatus as defined in claim 12,

a soldering apparatus wherein said flow soldering device has a solder supplying portion which is arranged on a side of said other surface of said interconnect substrate; and

said heater is arranged so as to extend from said solder supplying portion onto a lower stream side thereof in a transfer direction of said interconnect substrate.

[Claim 16] In the soldering apparatus as defined in any of claims 12 through 15,

a soldering apparatus wherein a plurality of such heaters are included; and

at least one of said heaters is a far infrared radiation heater.

[Claim 17] In the soldering apparatus as defined in any of claims 12 through 16,

a soldering apparatus wherein a fan is further included.

[Claim 18] In the soldering apparatus as defined in any of claims 12 through 17,

a soldering apparatus further including a reflow soldering device which bonds said first electronic component to said one surface of said interconnect substrate.

[Claim 19] In the soldering apparatus as defined in any of claims 12 through

18,

a soldering apparatus further including a second heater which preheats the bonding parts before performing the flow soldering.

[Claim 20] In the soldering apparatus as defined in any of claims 12 through 19,

a soldering apparatus wherein at least the part of said flow soldering device has a chamber.

[Claim 21] An apparatus for manufacturing an electronic circuit module, which includes the soldering apparatus as defined in any of claims 12 through 20, and which mounts the first and second electronic components on said interconnect substrate.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a soldering method, a soldering apparatus, and a method of and an apparatus for manufacturing an electronic circuit module.

[0002]

[Background of the Invention]

It is known to bond a plurality of electronic components to an interconnect substrate by combining reflow soldering and flow soldering. On that occasion, it is often the case that one surface of the interconnect substrate is subjected to the reflow soldering, whereupon the other surface is subjected to the flow soldering.

[0003]

Meanwhile, in recent years, it has been desired that the electronic components be mounted using a solder which contains no lead. However, electrodes on the sides of the electronic components have been often plated with a material containing lead, so that a metal layer containing lead has sometimes segregated at the interface of a solder bonding part having finished the reflow soldering, with the interconnect substrate. The

metal layer containing lead is lower in the melting point than a metal layer containing no lead, so that the solder bonding part of the electronic component mounted on one surface of the interconnect substrate has sometimes come off from the interconnect substrate on account of the heat of the flow soldering from the other surface.

[0004]

The present invention is for solving this problem, and has for its object to provide a soldering method, a soldering apparatus, and a method of and an apparatus for manufacturing an electronic circuit module in which the reliability of the electrical connection between electronic components and an interconnect substrate is high.

[0005]

[Means for Solving the Problem]

(1) A soldering method according to the present invention includes bonding a first electronic component which has electrodes plated with a material containing lead, to one surface of an interconnect substrate through a solder containing no lead, and bonding a second electronic component to the interconnect substrate by performing flow soldering onto the other surface; and

heats bonding parts between the first electronic component and said interconnect substrate at or after the step of performing the flow soldering, thereby to melt the bonding parts.

[0006]

According to the present invention, the bonding parts between the first electronic component and the interconnect substrate are heated at or after the step of performing the flow soldering. Thus, the bonding parts are wholly remelted. It is therefore possible to avoid that, in each bonding part, only a part containing lead of low melting point is melted by the heat of the flow soldering. It is accordingly possible to prevent the first electronic component from coming off from the interconnect substrate.

[0007]

(2) In this soldering method,

the step of heating the bonding parts may well be performed simultaneously with the step of performing the flow soldering.

[0008]

(3) In this soldering method,

the step of heating the bonding parts may well be performed after the step of performing the flow soldering.

[0009]

According to this measure, the bonding parts can be wholly melted finally.

[0010]

(4) In this soldering method,

the step of heating the bonding parts may well be performed simultaneously with and after the step of performing the flow soldering.

[0011]

(5) In this soldering method,

at the step of heating the bonding parts, the heating may well be performed by at least one of radiant heat and a hot blast.

[0012]

(6) In this soldering method,

the first electronic component may well be bonded to the first-mentioned surface of the interconnect substrate by performing reflow soldering.

[0013]

According to this measure, the first electronic component is bonded to the interconnect substrate by the reflow soldering, and the flow soldering is thereafter performed.

[0014]

(7) In this soldering method,

the first electronic component may well be bonded to the first-mentioned surface of the interconnect substrate by performing soldering by handwork.

[0015]

(8) In this soldering method,

it is also allowed to further include preheating the bonding parts before the step of performing the flow soldering.

[0016]

Thus, the bonding parts can be thereafter wholly melted reliably.

[0017]

(9) In this soldering method,

the solder containing no lead may well be formed of at least one material selected from the group consisting of tin, silver, copper, zinc and bismuth.

[0018]

(10) In this soldering method,

at least the step of heating the bonding parts may well be performed in a chamber.

[0019]

(11) A method of manufacturing an electronic circuit module according to the present invention mounts the first and second electronic components on the interconnect substrate by the above soldering method.

[0020]

(12) A soldering apparatus according to the present invention includes a flow soldering device which, when a first electronic component having electrodes plated with a material containing lead is bonded to one surface of an interconnect substrate through a solder containing no lead, bonds a second electronic component to the other surface of the interconnect substrate;

said flow soldering device being provided with a heater which is arranged on a

side of said one surface of said interconnect substrate, and which melts bonding parts between the first electronic component and said interconnect substrate.

[0021]

According to the present invention, the flow soldering device has the heater arranged on the side of the interconnect substrate on which the first electronic component is bonded. Thus, the bonding parts between the first electronic component and the interconnect substrate can be wholly remelted. It is therefore possible to avoid that, in each bonding part, only a part containing lead of low melting point is melted by the heat of the flow soldering. It is accordingly possible to prevent the first electronic component from coming off from the interconnect substrate.

[0022]

(13) In this soldering apparatus,

it is also allowed that the flow soldering device have a solder supplying portion which is arranged on a side of the other surface of the interconnect substrate; and

that the heater be arranged over the solder supplying portion.

[0023]

According to this measure, the bonding parts can be heated simultaneously with the flow soldering.

[0024]

(14) In this soldering apparatus,

it is also allowed that the flow soldering device have a solder supplying portion which is arranged on a side of the other surface of the interconnect substrate; and

that the heater be arranged on a lower stream side of the solder supplying portion in a transfer direction of the interconnect substrate.

[0025]

According to this measure, the bonding parts can be wholly melted finally.

[0026]

(15) In this soldering apparatus,

it is also allowed that the flow soldering device have a solder supplying portion which is arranged on a side of the other surface of the interconnect substrate; and

that the heater be arranged so as to extend from the solder supplying portion onto a lower stream side thereof in a transfer direction of the interconnect substrate.

[0027]

(16) In this soldering apparatus,

it is also allowed that a plurality of such heaters be included; and

that at least one of said heaters is a far infrared radiation heater.

[0028]

(17) In this soldering apparatus,

a fan may well be further included.

[0029]

According to this measure, the bonding parts can be efficiently heated.

[0030]

(18) In this soldering apparatus,

it is also allowed to further include a reflow soldering device which bonds the first electronic component to the first-mentioned surface of the interconnect substrate.

[0031]

(19) In this soldering apparatus,

it is also allowed to further include a second heater which preheats the bonding parts before performing the flow soldering.

[0032]

Thus, the bonding parts can be thereafter wholly melted reliably.

[0033]

(20) In this soldering apparatus,

at least the part of the flow soldering device may well have a chamber.

[0034]

(21) An apparatus for manufacturing an electronic circuit module according to the present invention includes the above soldering apparatus, and mounts the first and second electronic components on the interconnect substrate.

[0035]

[Mode for Carrying Out the Invention]

Now, preferred embodiments of the present invention will be described with reference to the drawings. The present invention, however, shall not be restricted to the embodiments stated below.

[0036]

Figs. 1 - 7 are views for explaining a soldering method and a soldering apparatus according to an embodiment to which the present invention is applied. In this embodiment, first electronic components 20, 26 are bonded to the first surface 12 of an interconnect substrate 10, and second electronic components 50, 52, 54, 56 are thereafter bonded to the interconnect substrate 10 by flow soldering.

[0037]

Figs. 1 and 2 are views showing the step of bonding the first electronic components 20, 26 to the interconnect substrate 10. In the illustrated example, the first electronic components 20, 26 are mounted by reflow soldering.

[0038]

A substrate having already been known may well be used as the interconnect substrate 10, and it is an organic or inorganic substrate on which interconnect patterns 16 are formed. The interconnect substrate 10 may well be termed a "circuit board" or "printed wiring board (PWB)", and it has various sorts of electronic components mounted thereon and is built in an electronic equipment. The interconnect substrate 10 may be either a rigid substrate or a flexible substrate, and it may be either a single-layer substrate or a multilayer substrate.

[0039]

The interconnect substrate 10 has the first surface 12, and a second surface 14 opposite thereto. Through-holes 18 through which the first and second surfaces 12, 14 are passed, may well be formed in the interconnect substrate 10 as may be needed. Parts of the interconnect patterns 16 are formed inside the through-holes 18, and the leads of the electronic components of through-hole type are inserted into them.

[0040]

First, a solder 30 is applied to the first surface 12 of the interconnect substrate 10. The solder 30 may well be applied to the lands of the interconnect patterns 16. Using the solder 30, the first electronic components 20, 26 are soldered to the interconnect patterns 16. Here, a solder containing no lead (lead-free solder) is used as the solder 30. The solder 30 is not restricted as to its material unless lead is contained, and it may well be made of a material which contains at least one of tin, silver, copper, zinc and bismuth. Mentioned as examples of the solder 30 are an Sn-Ag system, an Sn-Ag-Cu system, an Sn-Ag-Bi system, an Sn-Ag-Cu-Bi system, an Sn-Zn system, and an Sn-Zn-Bi system. Although the ratio of the materials constituting the solder 30 is not restricted, it may well be, for example, Sn(91%)-Zn(9%), Sn(89%)-Zn(8%)-Bi(3%), or Sn(89%)-Zn(8 - 1%)-Bi(3 - 10%). The solder 30 may be supplied in a necessary amount by printing or the like.

[0041]

Thereafter, the first electronic components 20, 26 are mounted on the first surface 12 of the interconnect substrate 10 through the solder 30. Here, the first electronic components 20, 26 are often surface-mount type electronic components (SMD). The surface-mount type electronic components are often bonded to the interconnect substrate 10 by reflow soldering. The first electronic components 20, 26 include electronic devices such as active devices or passive devices. The first electronic components 20, 26 may well be manufactured by packaging electronic

devices. Mentioned as examples of the first electronic components 20, 26 are semiconductor devices, resistors, capacitors, coils, oscillators, filters, temperature sensors, thermistors, varistors, variable resistors, or fuses.

[0042]

The first electronic components 20, 26 have electrodes (external terminals) which are bonded to the interconnect patterns 16. Besides, the electrodes of at least one of the plurality of first electronic components 20, 26 are plated with a material which contains lead. By way of example, the first electronic component 20 has leads (electrodes) 22, the surfaces of which are plated with the material containing lead. By the way, in the example shown in Fig. 1, the first electronic component 20 is a semiconductor device of QFP type.

[0043]

Subsequently, as shown in Fig. 1, the first surface 12 on which the first electronic components 20, 26 are mounted is subjected to a reflow step. More specifically, the interconnect substrate 10 is placed in a furnace which has a heater 40. The heater 40 is often arranged on the side of the first surface 12 of the interconnect substrate 10. Means having already been known can be applied to the reflow step.

[0044]

As shown in Fig. 2, the solder 30 is melted by the reflow step, and the first electronic components 20, 26 are bonded to the interconnect patterns 16 on the first surface 12. In more detail, as shown in the figure, a bonding part 32 which electrically connects the first electronic component 20 and the interconnect substrate 10 is formed between the lead 22 and the interconnect pattern 16.

[0045]

Here, since the lead 22 is plated with the material containing lead, a metal layer containing lead is partially formed in the bonding part 32 after the reflow step. In more detail, a first metal layer 34 containing no lead, and the second metal layer 36

containing lead are formed in the bonding part 32. The second metal layer 36 is often formed at the interface of the bonding part 32 with the interconnect pattern 16. In case of using the solder of the Sn-Ag-Cu system as the solder 30, the second metal layer 36 is formed of a metal of Sn-Ag-Pb system. Incidentally, the second metal layer 36 containing lead has the feature that the melting point thereof is lower than that of the first metal layer 34 containing no lead.

[0046]

According to this embodiment, as will be stated later, degradation in the connection strength of the first electronic component 20 to the interconnect substrate 10 can be prevented by eliminating a problem ascribable to the formation of the second metal layer 36 of comparatively low melting point.

[0047]

Apart from the foregoing example, the first electronic components 20, 26 may well be bonded to the first surface 12 of the interconnect substrate 10 by performing soldering by handwork. That is, the first electronic components 20, 26 may well be soldered by the handwork. Alternatively, the first electronic components 20, 26 may well be soldered by handwork combined with the above reflow soldering.

[0048]

Figs. 3 and 4 are views showing the step of bonding the second electronic components 50 - 56 to the interconnect substrate 10 by performing flow soldering. The flow soldering is performed for the second surface 14 of the interconnect substrate 10. Incidentally, the second electronic components 50 - 56 may be mounted on either the first surface 12 of the interconnect substrate 10 or the second surface 14 thereof.

[0049]

As shown in Fig. 3, the second electronic components 50 - 56 are mounted on the interconnect substrate 10. The second electronic components 50 - 56 may be either of surface mount type or through-hole type. The through-hole type second electronic

components (THD) 50, 52 are mounted on the first surface 12 of the interconnect substrate 10, while the surface mount type second electronic components (SMD) 54, 56 are mounted on the second surface 14 of the interconnect substrate 10. The through-hole type second electronic components 50, 52 are fixed by inserting their leads into the through-holes 18. On the other hand, the surface mount type second electronic components 54, 56 are stuck to the second surface 14 by an adhesive not shown. Incidentally, the second electronic components 50, 52 may well be disposed after the second electronic components 54, 56 have been stuck to the interconnect substrate 10.

[0050]

As shown in Fig. 4, the flow soldering is performed to bond the second electronic components 50 - 56 to the interconnect substrate 10. Here, a flow soldering device will be described. The flow soldering device according to this embodiment includes a solder tank (solder supplying portion) 60, and a heater 70 which is arranged on the side of the first surface 12. Incidentally, a soldering apparatus according to this embodiment includes the flow soldering device.

[0051]

The solder tank 60 is a device which is arranged on the side of the second surface 14 of the interconnect substrate 10, and which supplies a melted solder 62. The solder tank 60 may be either of stationary type or jet flow type. That is, the flow soldering may be either of dip scheme or jet flow scheme. In case of the jet flow scheme, the melted solder 62 put in the solder tank 60 is blown up by a pump (not shown) and is jetted toward the interconnect substrate 10 in accordance with the shape of a nozzle (not shown). On that occasion, the second surface 14 of the interconnect substrate 10 is heated. The melted solder 62 may be either a solder containing lead or a solder containing no lead (lead-free solder). An aspect having already been known may well be applied as a method of supplying the melted solder 62.

[0052]

The first surface 12 of the interconnect substrate 10 is also heated by the heat of the flow soldering applied to the second surface 14. Here, each of the bonding parts 32 on the first surface 12 is formed of the first metal layer (containing no lead) 34, and the second metal layer (containing lead) 36 the melting point of which is lower than that of the first metal layer 34. Therefore, a phenomenon can occur in which the second metal layer 36 is melted by the heating of the first surface 12, but the first metal layer 34 is not melted. As a result, the bonding parts 32 are partially melted, whereby even when they are thereafter solidified, the first electronic components 20, 26 sometimes come off from the interconnect substrate 10. In this embodiment, therefore, the bonding parts 32 are heated by the heater 70 in order to improve this problem.

[0053]

As shown in Fig. 4, the heater 70 is arranged on the side of the first surface 12 of the interconnect substrate 10. The number of heaters 70 may be either one or more. The heater 70 melts each solder bonding part 32 on the first surface 12. In more detail, in the bonding part 32, even the first metal layer (containing no lead) 34 having the melting point higher than that of the second metal layer (containing lead) 36 is melted. The temperature of the bonding part 32 heated by the heater 70 may well be, for example, about 180 to 230 °C. In more detail, the temperature of the bonding part 32 heated by the heater 70 reaches, not less than the temperature at which the first metal layer 34 is melted. By way of example, in a case where the first metal layer 34 is formed of a metal of Sn-Ag-Cu system, the temperature may well be about 217 to 221 °C.

[0054]

As shown in Fig. 4, the heater 70 may well be arranged over the solder tank 60. That is, each bonding part 32 on the first surface 12 of the interconnect substrate 10 may well be heated at the same time that the flow soldering is performed on the second surface 14. The heating based on the heater should preferably be performed, at least,

simultaneously with the flow soldering. Thus, the whole bonding part 32 can be efficiently melted by the heating of the heater (for example, the heater 70), in addition to the heat of the flow soldering.

[0055]

As shown in Fig. 5, a plurality of heaters 70, 170, for example, may well be juxtaposed so as to lie from a position over the solder tank 60, to the lower stream side thereof, in the transfer direction 80 of the interconnect substrate 10. In other words, it is also allowed to arrange the heater 70 over the solder tank 60, and to arrange the heater 170 over the lower stream side of the solder tank 60 in the transfer direction 80 of the interconnect substrate 10. According to this measure, each bonding part 32 is heated even after the end of the flow soldering, so that the first metal layer 34 having failed to be melted by the flow soldering can be thereafter melted. It is accordingly possible to melt the whole bonding part 32, and to thereafter solidify this bonding part in a good state by a surface tension. Incidentally, apart from the illustrated example, a single heater (for example, either the heater 70 or the heater 170) may well be arranged so as to extend from the position over the solder tank 60, to the lower stream side thereof.

[0056]

Alternatively, as shown in Fig. 6, each bonding part 32 may well be heated by the heater 170 immediately after the end of the flow soldering. That is, the heater 170 may well be arranged over the lower stream side of the solder tank 60 in the transfer direction 80 of the interconnect substrate 10. Also in this case, the whole bonding part 32 can be melted.

[0057]

Besides, the heating structure of each of the heaters 70, 170 is not restricted, and it may well be, for example, an infrared heater (including a far infrared heater). Insofar as the infrared heater heats by utilizing infrared radiation (including far infrared

radiation), the aspect thereof is not restricted. Alternatively, each of the heaters 70, 170 may well be a sheath heater or a coil heater. Besides, in the case of using the plurality of heaters 70, 170, heaters having structures different from each other may well be employed conjointly. A heating method may well be, for example, one which heats by the radiant heat of far infrared radiation or the like, one which heats by a hot blast, or one which heats by the combination of them. In the case of heating by the hot blast, the hot blast may well be applied to the interconnect substrate 10 by using a fan 72. Thus, the bonding parts 32 can be efficiently heated.

[0058]

If necessary, a second heater 74 may well be disposed which heats the bonding parts 32 on the first surface 12 before performing the flow soldering. The second heater 74 is arranged on the upper stream side of the solder tank 60 in the transfer direction 80 of the interconnect substrate 10. The second heater 74 should preferably be arranged on the side of the first surface 12 of the interconnect substrate 10. Since the bonding parts 32 can be preheated by disposing the second heater 74, the bonding parts 32 can be thereafter melted reliably. The heating structure and method of the second heater 74 are not restricted, and any of the aspects applied to the heater 70 stated before may well be applied by way of example. Incidentally, the interconnect substrate 10 may well be automatically transferred by transfer means 82.

[0059]

As shown in Fig. 7, the soldering apparatus may well include a chamber 90. The chamber 90 may well be disposed at the part of the flow soldering device as shown in the figure. Alternatively, the chamber 90 may well be disposed only at the part of the second heater 74, or it may well be disposed at a part including both the flow soldering device and the second heater.

[0060]

Incidentally, the soldering apparatus according to this embodiment may well

further include a reflow soldering device (not shown). The reflow soldering device is arranged on the upper stream side of the transfer means 82.

[0061]

In this embodiment, the flow soldering may well be performed using the flow soldering device stated above. Besides, the interconnect substrate 10 may well be coated with a flux before applying the melted solder 62. Thus, the wettability of the solder is enhanced, and the melted solder 62 can be supplied in a good state.

[0062]

If necessary, the bonding parts 32 on the first surface 12 are heated before applying the melted solder 62. They may well be heated by, for example, the heater 74 stated above. Thereafter, the interconnect substrate 10 is transferred, and the melted solder 62 is supplied onto the second surface 14. Besides, the bonding parts 32 on the first surface 12 are heated at or after the step of supplying the melted solder 62. The bonding parts 32 may be heated by, for example, the heater 70 stated above. The step of heating the bonding parts 32 may be performed either simultaneously with or after the flow soldering, and it may well be performed both simultaneously with and after the flow soldering. In the case of performing the heating step simultaneously with and after the flow soldering, the bonding parts 32 are continuously heated. The bonding parts 32 can be wholly remelted by these steps. That is, even the first metal layer 34 of each bonding part 32 as has the melting point higher than that of the second metal layer 36 is melted. According to this measure, the whole bonding part 32 is melted, so that the bonding part 32 is thereafter solidified again in a good state by a surface tension. Therefore, even after the flow soldering has ended, the connection strength of each of the first electronic components 20, 26 to the interconnect substrate 10 can be prevented from degrading.

[0063]

According to the soldering method of this embodiment, the bonding parts 32

between the first electronic components 20, 26 and the interconnect substrate 10 are heated at or/and after the step of performing the flow soldering. Thus, the bonding parts 32 are wholly remelted. It is therefore possible to avoid that, in each bonding part 32 of the first electronic component 20, only the part (second metal layer 36) containing lead of low melting point is melted by the heat of the flow soldering. It is accordingly possible to prevent the first electronic components 20, 26 from coming off from the interconnect substrate 10.

[0064]

An electronic circuit module may well be manufactured in such a way that semiconductor devices or other electronic components are mounted on the interconnect substrate 10 by the method stated above. That is, the contents stated above may well be applied to a method of and an apparatus for manufacturing the electronic circuit module. Also in such cases, the effects stated above can be achieved.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is a view showing a soldering method according to an embodiment to which the present invention is applied.

[Fig. 2]

Fig. 2 is a view showing the soldering method according to the embodiment to which the present invention is applied.

[Fig. 3]

Fig. 3 is a view showing the soldering method according to the embodiment to which the present invention is applied.

[Fig. 4]

Fig. 4 is a view showing the soldering method and a soldering apparatus according to the embodiment to which the present invention is applied.

[Fig. 5]

Fig. 5 is a view showing a soldering method and a soldering apparatus according to an embodiment to which the present invention is applied.

[Fig. 6]

Fig. 6 is a view showing a soldering method and a soldering apparatus according to an embodiment to which the present invention is applied.

[Fig. 7]

Fig. 7 is a view showing a soldering method and a soldering apparatus according to an embodiment to which the present invention is applied.

[Description of Reference Numerals and Signs]

10	Interconnect substrate
12	First surface
14	Second surface
20	First electronic component
22	Lead
26	First electronic component
30	Solder
32	Bonding part
34	First metal layer
36	Second metal layer
50	Second electronic component
52	Second electronic component
54	Second electronic component
56	Second electronic component
70	Heater
72	Fan
74	Second heater
90	Chamber

170 Heater

[Designation of Document] ABSTRACT

[Abstract]

[Problem] To provide a soldering method, a soldering apparatus, and a method of and an apparatus for manufacturing an electronic circuit module in which the reliability of the electrical connection between electronic components and an interconnect substrate is high.

[Means for Resolution] A soldering method includes bonding a first electronic component 20 which has electrodes 22 plated with a material containing lead, to one surface 12 of an interconnect substrate 10 through a solder containing no lead, and bonding second electronic components 50 - 56 to the interconnect substrate 10 by performing flow soldering onto the other surface 14, and bonding parts 32 between first electronic components 20, 26 and the interconnect substrate 10 are heated at or after the step of performing the flow soldering, thereby to melt the bonding parts 32.

[Selected Drawing] Fig. 4

FIG. 1

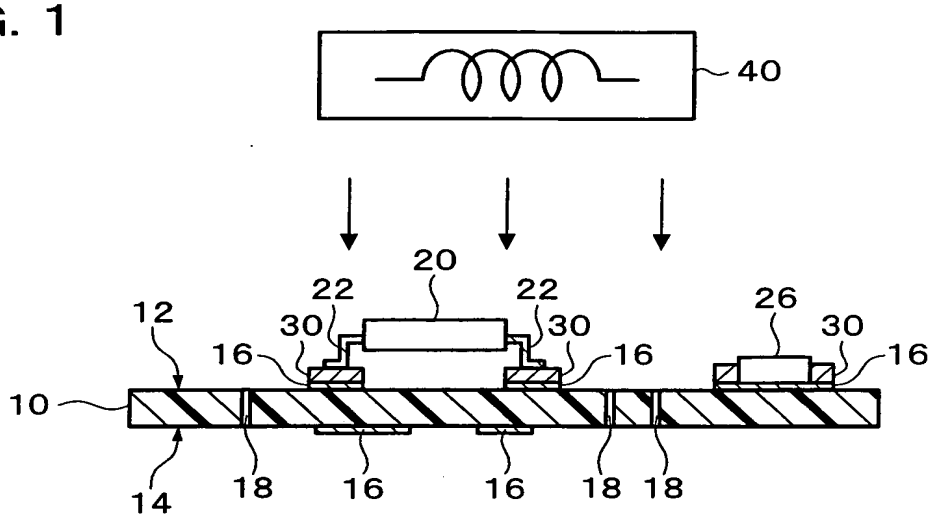

FIG. 2

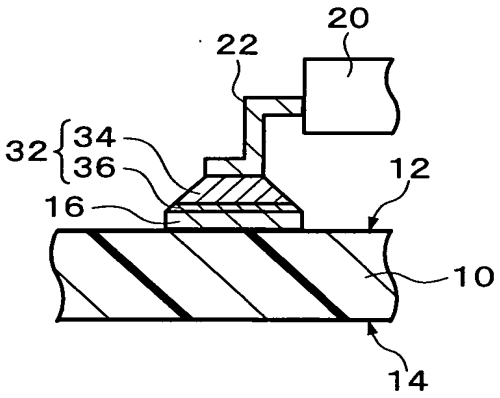

FIG. 3

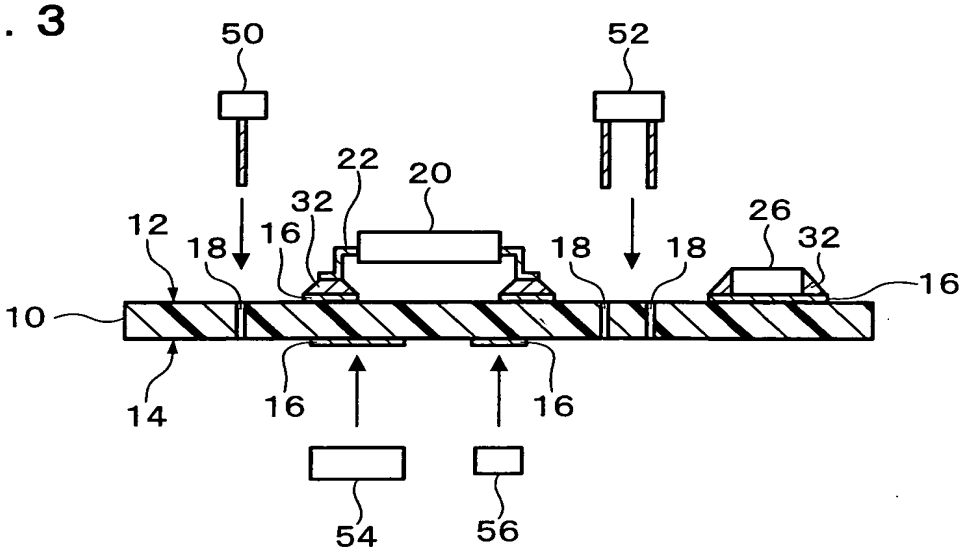

FIG. 4

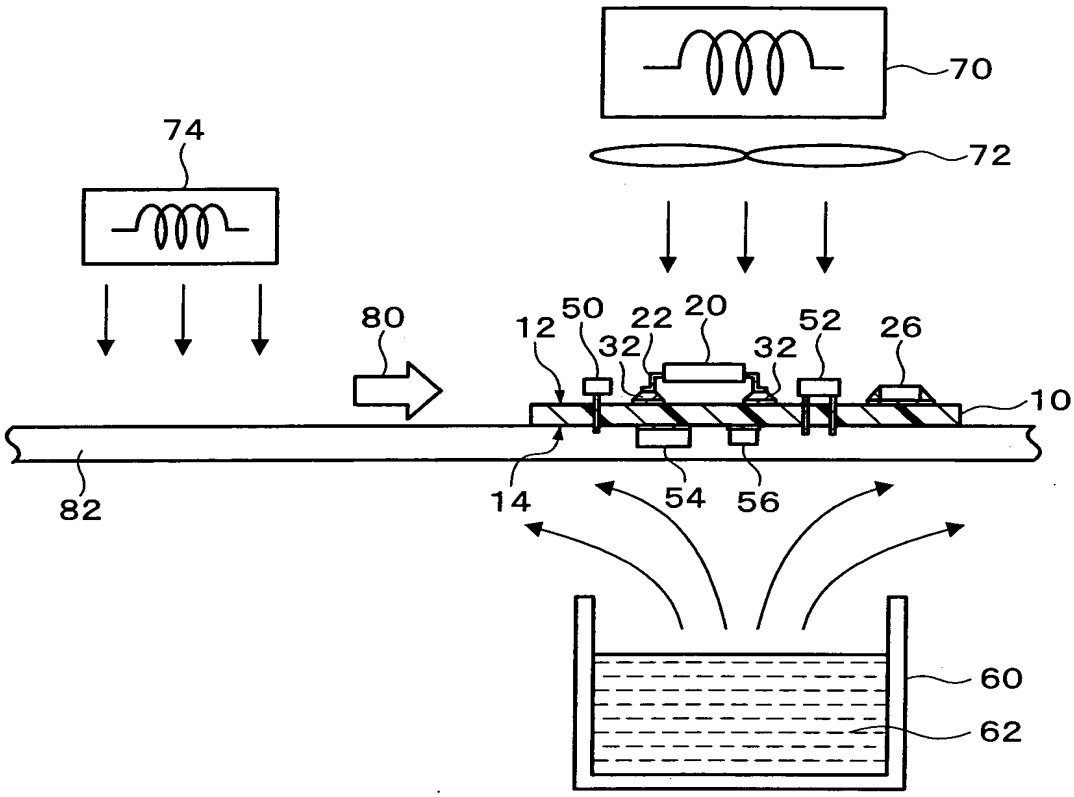

FIG. 5

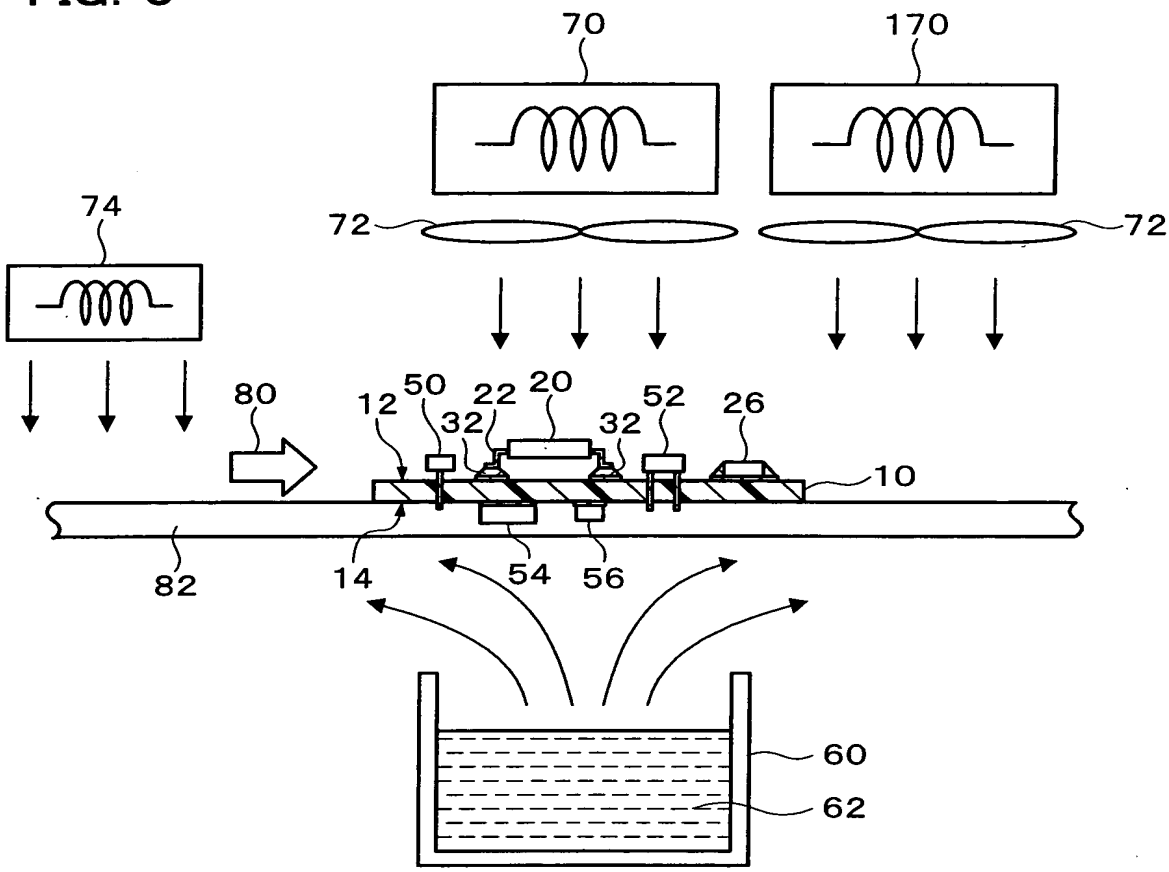

FIG. 6

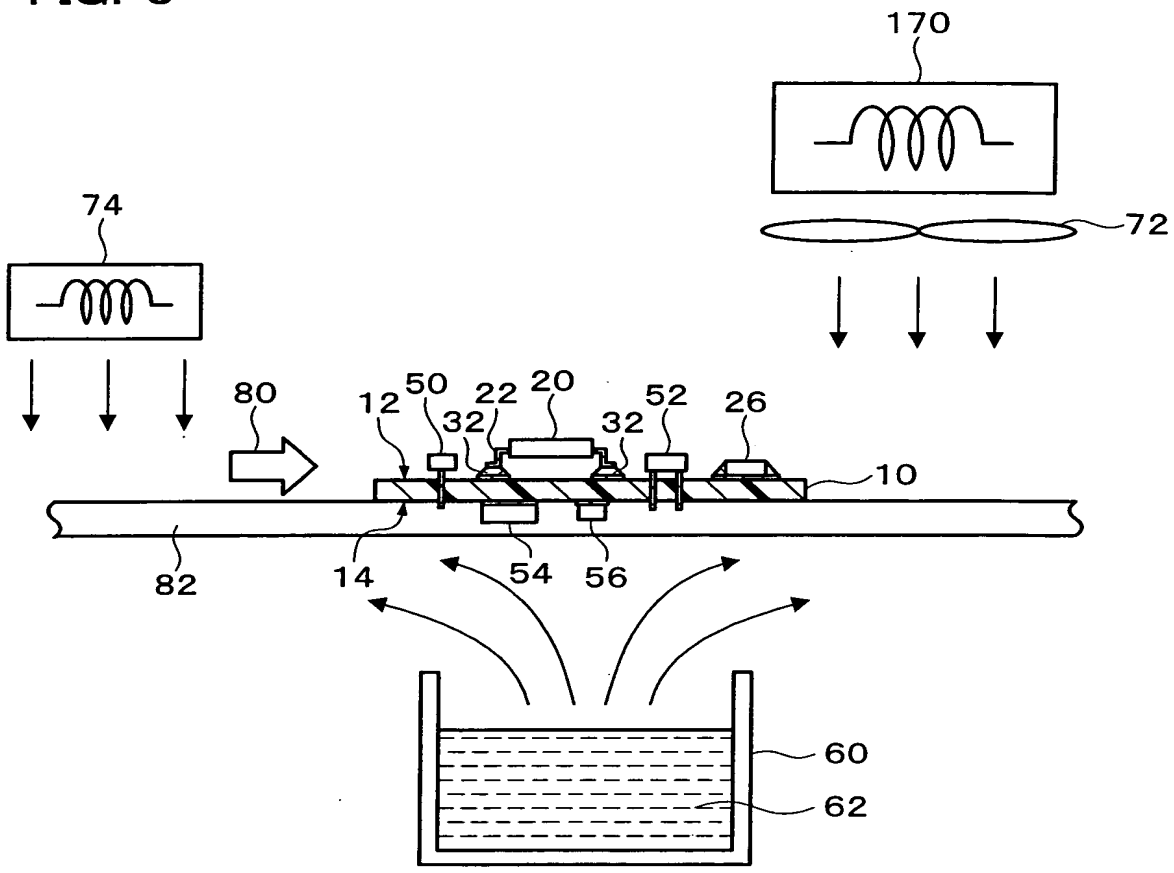

FIG. 7